Reconnaissance, Surveillance, and Targeting Vehicle (RST-V) 1997 DARPA TECH Conference

Dr. Art Morrish
Program Manager
Tactical Technology Office

1

Good afternoon, I'm Dr. Art Morrish, Program Manager for the Reconnaissance, Surveillance and Targeting Vehicle (RST-V) ATD.

Reconnaissance, Surveillance and Targeting Vehicle (RST-V)

Joint DARPA/USMC Program

Demonstrate Reconnaissance Surveillance and Target Acquisition (RSTA) Capability

Vehicle Will:

- Transport, power & protect RSTA & C^3 system
- Be V-22 transportable, highly survivable, mobile & sustainable

Program Enables SUO, Sea Dragon & Army After Next CONOPS

2

The RST-V ATD is a joint DARPA/Marine Corps effort to design and build a RSTA vehicle which

- is internally transportable in a V-22 Osprey aircraft;
- has better mobility than current HMMWV vehicles;
- and has advanced, integrated survivability designed in from the ground up.

The vehicle will provide transport for a 3-person team and their equipment.

This vehicle will also provide self-contained power for both organic and dismounted sensor and communications devices.

DARPA views this program as providing enabling technology for DARPA's Small Unit Operations program as well as Sea Dragon and Army After Next Concepts of Operation. Just as important, partnering with the Marine Corps will ensure that design efforts address needs stated by the Marines and other services, thus paving the way to expedite transition of developed technologies onto the battlefield.

Operational Concept

- V-22 Internal Transport
  - Deployment Ready
- Hybrid Electric Drive
- Integrated Survivability
  - Ballistic
  - AP Mine
  - Managed Signature
- Advanced Mobility
- RSTA & C^3 Integration
- All In An Affordable Package

3

The operational concepts that underlie this program have been defined by special operations, deep strike, and rapid force projection initiatives and rely on three non-tradable requirements.

First, as I stated previously, the vehicle must be internally transportable in an MV-22/CV-22 aircraft. Sling loading is not an option and neither is packing the vehicle in the aircraft in such a way that it takes hours to unload and deploy.

Secondly, the vehicle must have hybrid electric propulsion–there are several reasons for requiring this including to improve fuel economy, perhaps by as much as a factor of two over a similarly outfitted HMMWV; to provide a silent watch/silent movement capability; to provide a burst recharge capability for individual combatant gear; and to reduce thermal signature.

Which brings me to the third requirement–integrated survivability. Integrated survivability means ballistic protection–at least 7.62 mm protection for the crew from anti-personnel mines at a minimum, and managed vehicle signature–visual, IR, RCS and acoustic. Integration of the RSTA sensors and comms such that these signatures are not significantly compromised is a critical challenge.

Integrating these requirements into a highly mobile, affordable package is an encompassing goal of the program.

System Design Approach

Integration of Technologies is Key to This Program

Balanced Vehicle Design

- 3 Configurations - 1 design demonstrated
- Ability to reconfigure between designs

Only 3 Non-Tradable Items

- V-22 transportability, hybrid electric drive & integrated survivability

Affordability is an Independent Variable to be Traded Against Other Desired Capabilities

4 Tractability of User Needs is Critical

This program is an aggressive design exercise to integrate advanced technology into a balanced vehicle design. We're going to develop three configuration designs to provide the user community with some sense of the family of vehicles which can be based on these technologies:

- fully capable RST-V;
- a baseline vehicle with only the three non-tradable technologies; and
- the vehicle which will actually be built and demonstrated whose capabilities fit in between.

I will talk more about these designs in a moment. However, a key point about the design effort will be to demonstrate the ability to reconfigure between the baseline and the fully capable RST-V.

In the spirit of acquisition reform, we purposely kept our list of "requirements" small and put together a much larger list of desires which are tradable against each other, with cost as an independent variable.

The goal is to tell the contractors what we want and let them figure out how to do it, while maintaining direct user involvement. The user must be aware of the trades from the outset.

Design Configurations

Full Capability RST-V: AURP $750K

- Non-tradable capabilities, advanced mobility, full RSTA suite and advanced comms

Baseline: AURP $105-$120K

- Non-tradable capabilities and advanced mobility
- Must reconfigure to full capability RST-V

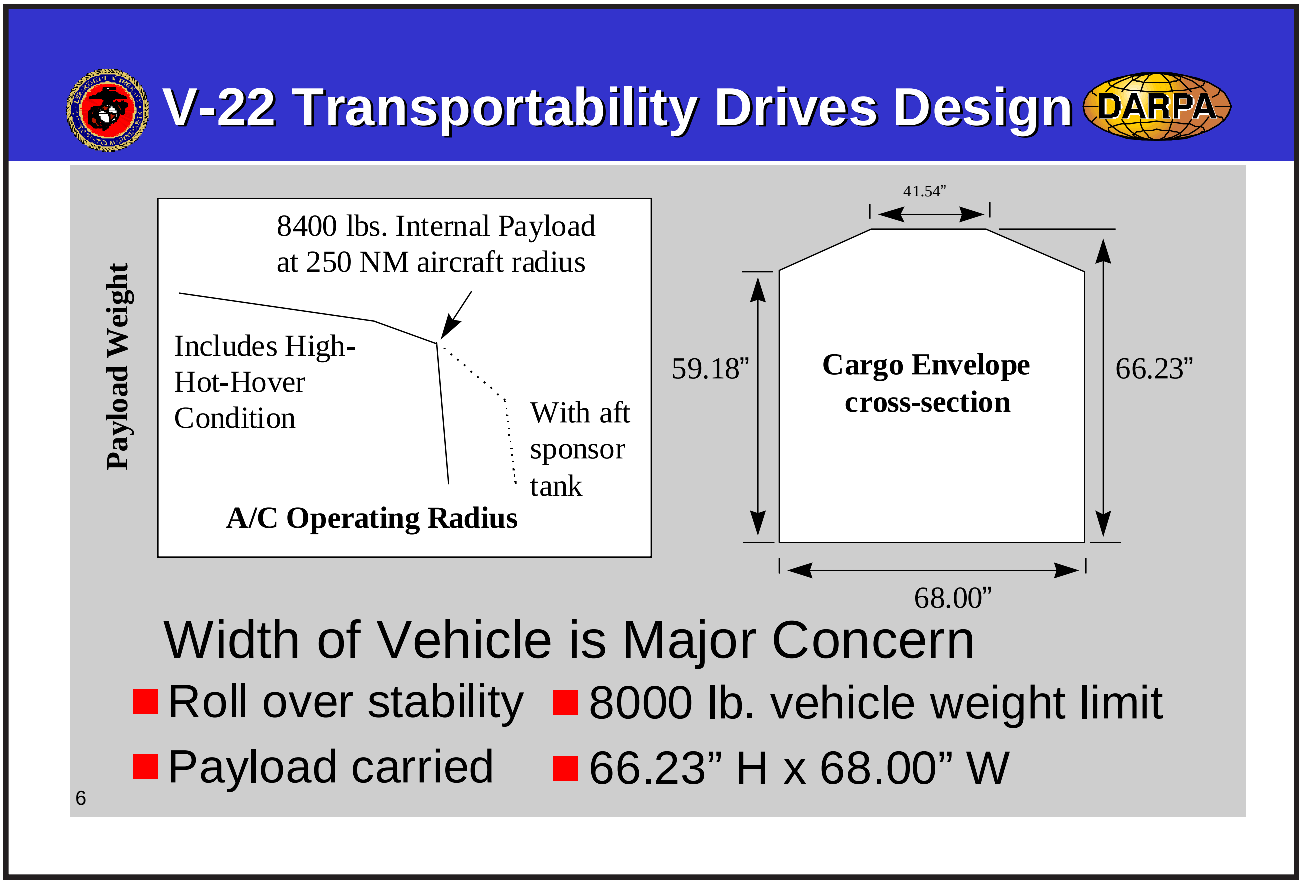
Demonstration Vehicle: Baseline Vehicle Plus

- LO mast, antennas and sensor shroud
- Minimum RSTA & comms capability necessary to demonstrate successful integration

5

As I discussed a moment ago, there are three configurations which will be designed for the program:

- the Full Capability RST-V, which is where most of the design effort will be spent;
- the baseline vehicle, which will have only the non-tradable requirements and advanced mobility; and
- the demonstration vehicle, which will be designed to Full Capability RST-V requirements but will not actually contain much of the desired sensor and comms package, although mast, sensor shroud, apertures and antennas will be integrated.
- The Full Capacity configuration is the building block for the subsequent designs such that reconfiguring and deconfiguring should not be a major time-consuming process.
- Another important part of this program is to control cost from the beginning and to provide the user with realistic costing information. Therefore we are establishing Average Unit Roll-Away Prices (AURP) for both the RST-V and the baseline vehicle. These prices are based on a notional buy of 300 vehicles. Options are included in the contract to purchase up to 29 baseline and 10 Full Capability RST-V's to better establish the price points if the user desires.



Internal V-22 transportability imposes a major design challenge. To fit inside the cargo compartment, the vehicle must be less than 66 inches tall by 68 inches wide at its highest and widest points, successively, and have a gross vehicle weight of no more than 8000 lbs. The weight limit allows the user to have a 250 nmi unrefueled aircraft range and to meet the high-hot-hover requirements.

A narrow vehicle such as this can have a potentially serious rollover problem. We expect that the much lower center of gravity allowed by the hybrid electric propulsion will help alleviate this issue. Several innovative, advanced suspension designs also show a lot of promise.

We speculate the vehicle will have a payload on the order of 3000 lbs (HMMWV is 2500 lbs). The issue will be maintaining the center of gravity as low as possible and staying inside the box imposed by the cargo cross-section of the aircraft.

Hybrid Electric
Challenges and Advantages

- Power Distribution/Source Management Architecture
- Cooling HEV Subsystems (Hot Weather Issue)
- APU Battery Pack Mass and Volume
- Operational Enhancements
  - Agility
  - Fuel efficiency
  - Silent watch/movement
  - Reduced signature (acoustic, IR)
- On Board Power Supply

7

Hybrid electric vehicles have multiple power sources and multiple power sinks. The distribution of power between the sources and sinks requires a flexible, bi-directional, electrical architecture as well as real-time management of distribution priorities. The challenge is to identify a system that does not represent a significant weight penalty.

Inherent to this architecture are multiple motors, inverters, or converters whose inefficiencies result in dissipated heat. Cooling becomes difficult in environments where the temperature delta between the heat source and the ambient air is small (e.g., 20 degrees F).

As the vehicle's gross weight must come in under 8000 pounds, the mass of the engine-generator and battery pack must remain a small percentage of the vehicle's overall weight. These parameters will most likely be traded against mission capabilities such as sprint speed, silent watch and silent mobility duration.

The expected advantages of utilizing a hybrid electric configuration include enhanced survivability by increasing its cross country speed, thus bettering the crew's chances of avoiding danger; the ability to move about with virtually no audible signature and limited IR signature; and the ability to be self-sufficient, thus be able to carry and operate numerous sensors and defensive weapons for extended missions.

RST-V Program Drivers

USMC MV-22 Capability Required

- Light Strike Vehicle operational requirements
- Long Range ground reconnaissance (Division-Deep, ACMC Feb. 96)

USSOCOM CV-22 Required

- Deep insertion/extraction
- Special operations missions/deep reconnaissance

8

The user requirements provide a focus for this ATD. The Marines and USSOCOM have a real need for a V-22 deployable vehicle like the RST-V. We have direct user involvement to make sure that the trades that we make in this process are ones that they can live with.

RST-V Acquisition Strategy

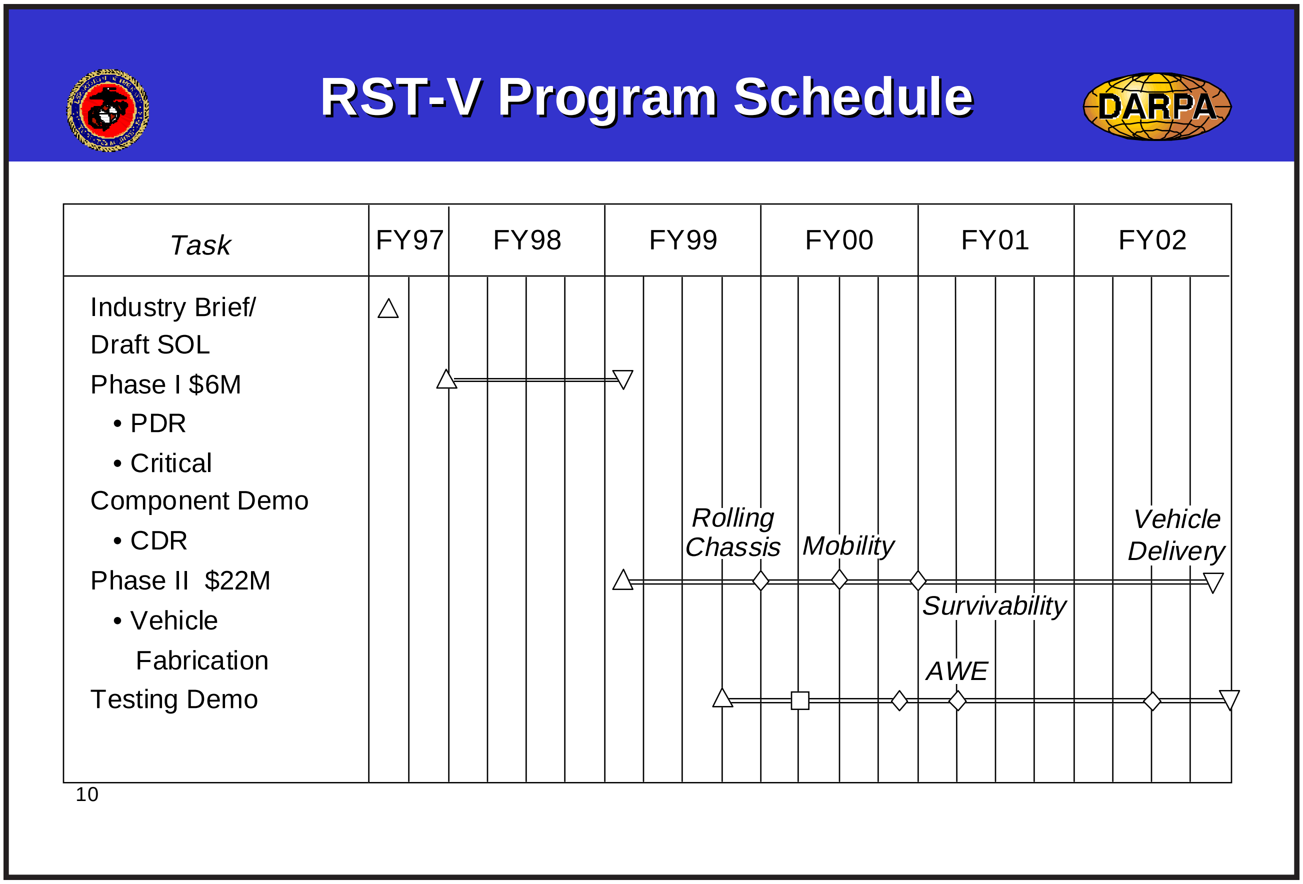
Two-Phase 804/845 Acquisition

- Phase I: multiple awards – notional 2 through CDR
  - Preliminary system designs
  - Risk reduction/critical item demonstrations
  - CDR and proposal for Phase II
- Phase II: contractor down select – one award
  - Sequential testing of key capabilities – mobility, survivability, RSTA
  - Government testing participation in ACTDs
  - Production of two ATD vehicles
  - Potential multi-vehicle buy options

9

I would like to take the last few minutes to briefly describe the program's acquisition strategy and schedule. We are using DARPA's 845/804 authority to do an "Other Transactions" agreement. This is the same acquisition model used for Tier II+ and Arsenal Ship. Under this arrangement the government tells the contractor what they want, not how to do it, thus allowing the contractor to use best business practices to get the job done.

The program will consist of two phases. Phase I will be a multi-contractor competition with the CDR as its exit milestone. A contract down select will be held between Phase I contractors to determine the one contractor that will be carried forward through Phase II to fabricate two demonstration vehicles and support testing in government tests, advanced warfighter experiments and ACTDs. At the end, as I mentioned previously, there are several options to buy a limited number of additional prototype vehicles to support further testing and evaluation.



The estimated value of Phase I is 6 million dollars, approximately 3 million per contractor assuming two are chosen and Phase II has a contract value of approximately 22 million dollars.

Some of the critical milestones for the program are PDR at 5-7 months, CDR & Phase II start in 1st quarter FY 99, completion of a rolling chassis in early FY 00 and participation in the Capable Warrior Advanced Warfighting Experiment (AWE) in early FY 01. The Capable Warrior AWE is a strong pacing element for the program since it provides an ideal opportunity to demonstrate the vehicle's abilities in a realistic environment. We will also be coordinating with other DARPA programs to identify potential enabling technologies for SUO connectivity as this concept evolves.